REMARKS/ARGUMENTS

Reconsideration and withdrawal of the Examiner's rejection of the above-identified application is respectfully requested in view of the foregoing amendments and following remarks. Claims 16-30 are in the application. Claims 16, 28 have been amended. No new matter has been added.

The Examiner rejected claims 16 and 28 under 35 U.S.C. §112. Applicant has amended claims 16 and 28 in accordance with the Examiner's instructions and to be consistent with the previously amended claims and specification.

The Examiner rejected claims 28-30 as being anticipated by *Kerber* and rejected claims 16, 18-21, 23-24 and 26-27 as being unpatentable over *Kerber* in view of *Suzuki et al.* and *Dearnaley*. Claims 22 and 25 are rejected over *Kerber* in view of *Suzuki* and further in view of *Engel*. Claim 17 is rejected over *Kerber* in view of *Suzuki et al* and *Dearnaley* and further in view of *Kazakou '971*. Applicant respectfully traverses. Claim 16 has been amended to indicate that the ion implantation takes place simultaneously with the ion plasma deposition. Claim 18 has been amended to indicate specific thickness of each of the layers. Support for these amendments can be found on pages 4 and 5 of the specification and in claim 21.

Kerber teaches only about multilayer coating, which contains successive alternation of two functional layers, one metallic and one ceramic. The patent does not consider the issues of retaining fatigue characteristics of parts coated; there is no simultaneous ion implantation as claimed in claim 16, and no suggestions to use three functional layers with the certain ratios of thickness as claimed in claim 28 to provide the improved wear resistance.

The layers according to *Kerber* are 0.1 - 0.5 microns in thickness, and the ratio of thickness of ceramics (0.5 microns) and metallic layer (2.0 microns) is quite different from the claimed invention, which specifies that ceramic layer is thicker than the metal layer (see amended claim 28) and only this condition provides for the improved properties for gas turbine blade application.

US Patent 4,683,149 Suzuki et al describes forming films by means of ion implantation and vapor deposition, which are supposed to be carried out by turns. *Suzuki* also claims an apparatus for this process to increase corrosion resistance or adhesive properties.

US Patent 4,629,631 to Dearnaley teaches about the hardening process of the metal surface by means of sequential implantation of ions into the metal surface and ion-stimulated diffusion.

US Patent 3,915,757 Niels N. Engel teaches about the method for ion plating to improve hardness by means of implanting metal ions into the surface of hardened steel or by means of implanting nonmetal ions into metallized surface

Combining the teachings of *Kerber* with the teachings of *Suzuki* and *Dearnaley* or *Engels* would not lead to the invention claimed in claims 16-27, because none of the cited references teach the process of subjecting at least one of the layers with ion implantation simultaneous with the ion plasma deposition step. This is an important feature of the invention, and is not taught or suggested by any of the cited references.

Unlike the cited patents, the present application teaches about at least three layers, and there may be a few intermediate gradient zones between them albeit with small thickness (fractions of a micron). The layers of pure metals or the substitution alloys thereof (for instance, titanium and zirconium) are the most plastic layers in the whole system of the coating. Then the layers of interstitial alloys are formed by

means of the dosed supply of gaseous phase and, finally, the layers of interstitials of great hardness (nitrides, carbides, carbonitrides, borides, etc.) are formed. Only by following the method claimed it is possible to obtain the system of coating that provide the improved wear-resistance properties.

The maximum effect of wear-resistance (up to 75 times as compared to the uncoated condition) and the optimal improvement of other properties in the claimed technology are achieved only when implantation is applied during the course of coating deposition and simultaneously with the process of interstitial phase formation. As this occurs, the high-energy ions of 10^{14} - 10^{18} eV get involved in the formation of interstitials concurrently as these phases are being formed from the metal ions of the cathode surface of ion-plasma gun and from the nonmetal ions of gaseous phase. These conclusions are stated in the description and are illustrated in Fig. 3 thereof. The processes developed and available in literature thus far are designed either to improve adhesion or to form by implantation a solid and hard structure of carbides or nitrides on the surface.

Claim 28 also claims a certain thickness ratio of all three layers of the coating that provide the maximum effect of improving wear resistance: 1:2:2.5, i.e. the layer of minimum

strength and maximum plasticity should be half as great as compared to the layer of interstitial solid solutions and 2.5 times thinner than the layer containing the interstitial phases of maximum hardness and wear resistance. This ratio of layers provides the maximum effect for such parts as aircraft blades and power installations that operate under erosive conditions of media containing particles incident on the surface at the attack angle ranging between 0 and 90 degrees. Such ratio has never been claimed in any of the cited patents.

The formation of multilayer coatings containing alloys of various compositions and various structures is made possible by the use of 3 ion guns with various cathodes and an ion implanter in order to form high energy ion flow. None of the cited patents cover such conditions to obtain coatings. This process can be used to reshape the geometry of parts during repair by coating the alloys which composition is close to the composition of the substrate. Such method that would imply coating from a cathode of the same alloys as the substrate has not been described in the cited prior art.

Regarding the rejection of claim 17, vibro-treatment with micropellets is not a mechanical hardening process such as shot-peening as disclosed in *Kazakou*, but is a vibratory and

impingement effect on the coating that only has the purpose of improving the quality of surface (removing micro drop phase) and to redistribute residual stress. Therefore, the process of claim 17 does not result in hardening but provides improved durability of coating under operating conditions.

Accordingly, Applicant submits that claims 16-30 are patentable over the prior art, taken either singly or in combination. Early allowance of the amended claims is respectfully requested.

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Enclosure: Copy of Petition for a Three-Month Extension of Time
Request for Continued Examination (RCE) and check in the amount of $375.00 for a Small Entity.

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